

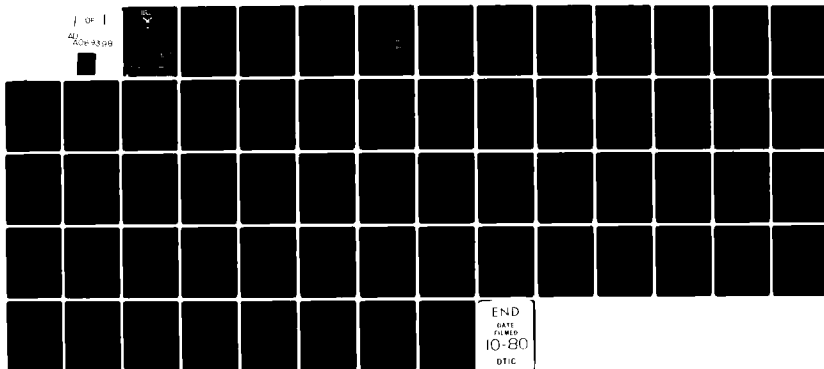
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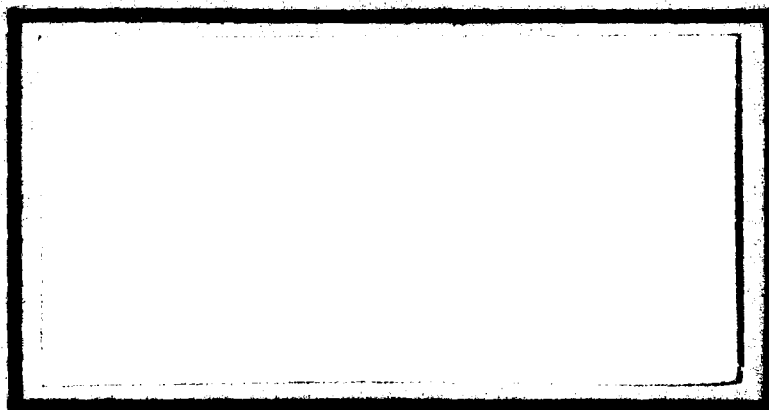
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COMPUTED MISTR REQUIREMENT CHANGES
AND PARTS SUPPORT
ANALYSIS OF A MISMATCH.

Matthew R. McGuire/ GS-11

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has been accepted by the undersigned on behalf of the faculty
of the School of Systems and Logistics in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT

DATE: 9 June 1980



COMMITTEE CHAIRMAN

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CHAPTER I

BACKGROUND

One of the primary responsibilities of the Air Force Logistics Command (AFLC) is the determination of material requirements for Air Force centrally procured items (1:p.1-1). A part of this responsibility is to insure that optimum material support is available with a minimum cost to the national economy (1:p.1-1). In order to achieve this objective, the AFLC uses an economic order quantity (EOQ) philosophy whereby requirements for items are computed to maintain stock at a level which will both satisfy customer demands and provide the minimum ordering and holding costs (1:p.2-1). EOQ items are nonrecoverable (they can be thrown away after use) and officially cataloged with expendability, recoverability, repairability category (ERRC) codes XB3 and XF3. These items are categorized based upon the dollar value of their projected annual demands or frequency of demands (3:p.1-1).

EOQ XB3 items are the repair parts that have a unit price of less than \$10 or characteristically cannot be repaired. Upon failure or wearout, these items are removed from inventory (1:p.2-1) and discarded. EOQ XF3 items are

recoverable spare items that have a unit price of \$10 or more but less than \$100, and have characteristics which prevent repair (1:p.2-1). These repair parts and spares are used as components of other items which can be repaired rather than discarded. These repairable items are recoverable, or exchangeable, assets.

AFLC also has the responsibility to provide a depot level repair program for recoverable spares at its five Air Logistics Centers (ALCs). These recoverable spares are designated ERRC code XD2 and are subject to both repair and reuse. Recoverable spares or exchangeable assets are those items which cost less to repair than replace. There are two types of AFLC depot level repair. One type of repair is organic, the other type is contractual. Organic repair is provided for in-house by ALC personnel, and contractual repair is conducted by civilian firms.

The system to manage the depot level repair/overhaul of exchangeable items (XD2) is the Management of Items Subject to Repair (MISTR) System. A highly mechanized computer network, MISTR interfaces, or connects, several computer systems providing quarterly and annual workload projections, and biweekly scheduling and production data for exchangeable (XD2) items (2:p.1-33; 5:pp.2-2 to 2-3).

The MISTR system is fed by two requirement computer

systems, the Equipment Item Requirements System (D039) and the Recoverable Consumption Item Requirements System (D041). The projected quarterly repair requirement for each national stock number is validated or adjusted by the Item Management Specialist (IMS). This validated or adjusted requirement is the input for the Repair Requirements Computation System (D073). The D073 output becomes the input to the Organic MISTR Requirements Scheduling and Analysis (G019C) or Contracts Scheduling and Analysis (G019F) to refine, update, and schedule workloads for upcoming negotiation and production time periods (5:p.2-1).

The following is a brief description of the various computer systems that are referred to in this thesis:

1. The D039 provides complete and adequate, current and projected equipment item requirements. The asset data are included in the requirements computation by the IM in order to provide timely support (4:p.1-1). The D073 system is furnished a projection of anticipated equipment item repair requirements by specific stock numbers for use in developing repair programs (4:p.7-1).

2. The D041 provides the computations for expendable investment recoverable spares. The requirements computed through this system reflect the average material support requirements for Air Force operations (2:p.1-1).

3. The D062 computes wholesale stock levels and material requirements for all centrally procured items identified by ERRC codes XB3 and XF3 (3:p.1-2).

4. The D073 manages depot level repair requirements in three basic frames: (a) Long Range (seven year) projection, (b) Intermediate Range (quarterly), and (c) Short Range (every two weeks) (5:p.4-1).

5. The G019C records organic negotiations for scheduling organic work hours (4:p.4-1).

6. The G019F records contractual requirements for determining contractual repair quantities (4:p.4-1).

These systems are interfaced as shown in Fig 1-1.

Statement of the Problem

The requirement for the repair of recoverable items continually changes and repair parts are not always readily available to support these changes. In the first quarter of Fiscal Year 1980, 197 of 1400, or approximately 15 percent, of investment recoverable items earmarked for repair by the MISTR requirements system (D073) are adjusted with pen or pencil. These changes are made by Investment Item Management Specialists during repair negotiations each fiscal year quarter for a number of reasons, some of which are:

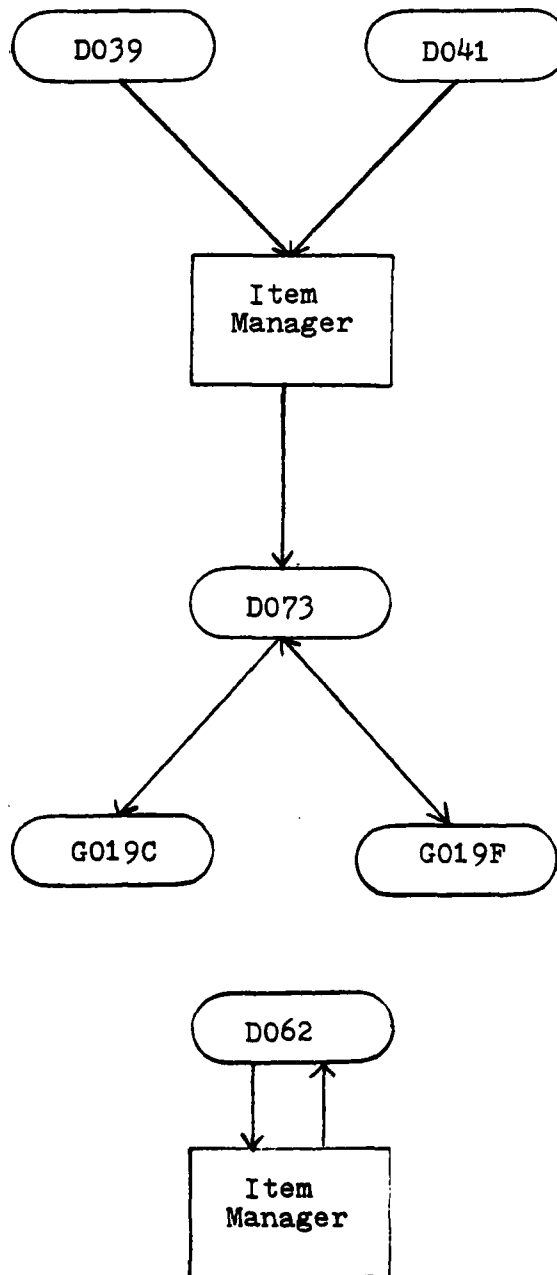


Fig 1-1. D073 and D062 IMS Flow Diagrams

1. Foreign Military Sales (FMS) requirements data are not provided for in the MISTR requirements system.

2. Programmed changes in flying hours and in maneuvers are not included in the requirements computations in sufficient time to be included in the quarterly requirement readouts.

3. The D041 data (2:p.1-1), the source for the requirements used in the D073 system, are approximately six months old by the time they affect repair.

The Investment IMS does not alert any Economic Order Quantity IMS that the requirements for his managed EOQ part may go up or down as a result of a pen or pencil change to computed requirements data. The MISTR items (D073) being repaired do not allude to any EOQ parts, and the parts in the EOQ usage system (D062) do not allude to the equipment supported.

To eliminate this problem, AFLC is attempting to interface the D073 with the D062. The concept is to have the EOQ parts requirements react to the changes in requirements of the equipment they support. Unfortunately, the enormity of the task and other pressing workloads has placed the interface attempt on the "back burner" (9). However, if the D073 was interfaced with the D062, there would still be no provision for the pen or pencil changes because they are not in the computer.

There are other unprogrammed requirements that can adversely influence EOQ parts support; however, they occur intermittently and their existence is not predictable. Because unprogrammed requirements can affect EOQ support, they may be encountered during the analysis phase of this thesis. If encountered, they will be addressed at that time. Some of these unprogrammed requirements are:

1. The Army, Navy, and other Air Force facilities cause unforecast requirements for EOQ parts support (6). These unforecast requirements are the result of the Weapons Integrated Material Manager (WIMM) programs (3:p.10-1) and (11).

2. The emphasis on requiring contractors to use only Government Furnished Materials (GFM) on contracts has recently changed to requiring GFM on contracts only when it is necessary to repair the item. For example, the repair parts support is solely available through government sources. The reason for the emphasis change is that the GFM usage on repair contracts has not been cost effective (14). Since the use of GFM has been de-emphasized on contract repair, the change in GFM usage during repair results in a lack of EOQ requirement data when the repair candidates are brought in-house for organic repair (for the most part, repair contractors now order repair parts from commercial sources).

This lack of information about EOQ usage affects AFLC EOQ support capabilities.

3. New weapons systems are usually repaired by prime contractors and subcontractors. This is because of warranty considerations, lack of repair technical data, the need to allocate manpower, the need to obtain the right test equipment, or the need to obtain sufficient repair parts. These contractors do not order EOQ parts from ALC sources. They may either manufacture their own or buy from other commercial sources.

Objective

The objective of this thesis is to study the following data in order to determine if EOQ parts support is affected by the Investment Item Management Specialist (IMS) practice of adjusting D073.X21 reports but not notifying the EOQ IMS of these adjustments. The data to be studied are fourth quarter Fiscal Year 1979 and first quarter Fiscal Year 1980 reports and worksheets listed:

1. Item Manager Projection Worksheet (D073.X21)
2. Material Requirements List (D049.445B)
3. Transaction Registers from G062
4. Output generated by G019C
5. Maintenance Inventory Control Records
6. Output generated by G062 for IMS

Research Hypothesis

The pen or pencil adjusting of the Air Force Logistics Command's computed depot repair requirement has an adverse impact on Economic Order Quantity parts support.

CHAPTER II

METHODOLOGY

Universe

There are approximately 18,000 items which are categorized under the MISTR system (8). These items are managed and monitored by the AFLC Air Logistics Centers (ALCs) located at Sacramento, California; Ogden, Utah; Oklahoma City, Oklahoma; Warner Robbins, Georgia; and San Antonio, Texas. Each ALC is further separated into Directorates. Each Material Management Directorate is divided into Divisions, each with similar functions and controlled by similar directives. The Divisions manage both contractual and organic repair items. This study will be directed toward organic repair item requirements.

Population

Each ALC is considered to have a representative number of MISTR items, and the same regulation (AFLCR 65-12) is used by all Material Management Divisions, so the sample for this study will be taken from Sacramento Air Logistics Center.

To further limit the study, "I" Division will be selected as representative of all ALC "I" Divisions.

Sampling Plan

A survey of the 1400 "I" Division organic MISTR items will be conducted to obtain the stock numbers of all items which had undergone pen or pencil changes to the computer generated requirements report (D073.X21). In order to use the most recent data available at the time of this study D073.X21's for the first quarter, Fiscal Year 1980, will be used and the items which reflect pen or pencil changes of three or more will constitute the population of data.

Data Collection

First, a data base consisting of national stock numbers of items with changed requirements as indicated by pen or pencil changes to the first quarter, Fiscal Year 1980, D073.X21 reports will be collected.

Second, in order to match the reduced requirement MISTR items to the various EOQ parts that may be needed for repair, the Material Requirements List (MRL or D049.445B) will be surveyed.

Third, the G019C MISTR reports will be investigated for the national stock numbers of the selected sample of

interest that reflect pen or pencil increase changes. Specific information to be extracted is any backordered EOQ parts needed for the repair of the increased requirement of any item in the sample.

Fourth, the D062 transaction register used by the ALCs EOQ IMSS to control their assets will be checked and telephone calls to the appropriate Defense Logistics Agency (DLA) IMSS will be made to see if the MISTR item requirement changes (pen or pencil) have caused a surplus or shortage of the EOQ part.

During the collection of data for the increased requirement the researcher will have to address several questions:

1. Did the pen or pencil change generate a backorder or overage?
2. What parts are needed to repair the MISTR item?
3. In what quantity are the parts needed?
4. Who manages the part?

These questions will be answered during the course of data collection.

When the desired population has been obtained, consideration will be given whether a census, or a sample, or a decision rule should be used for the analysis. The census may be over 200 items. It would not be feasible from a cost or time standpoint to analyze a census of that size.

Since the census will be from a finite population, a sample can provide reliable and more timely information than a census. The determination of sample size, if needed, will be made after the census is taken.

Variables

There will be two variables under study in this thesis. The independent variable will be the pen or pencil changed MISTR repair requirements and the dependent variable will be the Economic Order Quantity parts that are affected by the manually changed requirements.

Testing the Hypothesis

The census/sample MISTR items will be checked for parts backordered at the end of quarter one, Fiscal Year 1980. Those items that have EOQ parts backordered will be re-searched with the EOQ IMS to check the impact pen or pencil changes to the requirements had on the EOQ parts shortage. Those items that reflect pen or pencil reduction in requirement will be searched for EOQ parts surpluses through the EOQ IMSs. It is not planned to make statistical inferences in this thesis. However, percentage comparisons will be carried out, as necessary.

Assumptions

The following assumptions are made:

1. EOQ parts support is affected by unprogrammed requisitions.
2. Pen or pencil changes to requirements will continue to occur.
3. All ALCs provide manual changes to D073.X21s in accordance with AFLCR 65-12. For an example change, see Figures 2-1 and 2-2.

IMS Reason Codes

	<u>Code</u>	
First Position	O	Organic Repair
	C	Contract Repair
Second Position	E	Error
	S	Scrubbed
Third Position	P	Plus
	M	Minus

Fourth and Fifth Position

<u>Code</u>	<u>Code</u>
01 Usage Factors	16 ICS (Inter Cont Support)
02 Program Changes	17 RIW (Rel Impr WAR)
03 URC Changes	18 Prepositioned Rqmts
04 I & S Group Changes	19 OWRM Rqmts
05 Order & Ship Time	20 Serviceable
06 Base Repair Cycle	21 Serv (WRM Base)
07 Base Safety Level	22 Serv (WRM Depot)
08 Base Neg. Level	23 Unserviceable
09 Depot Stock Level	24 Due-In from Overhaul
10 Total Overhaul Stock Level	25 Unserv (WRM Depot)
11 Repair Leadtime Rqmt	26 On-Order (Peacetime)
12 NSO/INS Level	27 On-Order (WRM)
13 FMS Additives	28 Due-In Assets
14 Additive Requirements	29 SICA
15 Stock Due Out (DOTM)	

PMS Reason Codes (PMS: Production Management Specialist)

	<u>Code</u>	<u>Definition</u>
First Position	O	Organic
	C	Contract
Second Position	P	Plus Adjustment
	M	Minus Adjustment
Third Position	1	Repair to be Accomplished under RIW
	2	Repair to be Accomplished under ICS
	3	Unsaleable Workload--Used when both organic and contract services have declined negotiations
	4	Over/Under Production--used to adjust negotiation quantity to requirements. These adjustments will impact funding requirement only between AY and BY.

Fig 2-1. D073.X21 MANAGER ADJUSTMENT CODES

IM INTERMEDIATE RANGE										PAGE 001	
PROJECTIONS WORKSHEET										PROCESSING DATE: 28 JAN 79	
EQUIP SPEC:										REQUIREMENTS DATE: 30 JUN 77	
SUBGROUP MASTER MSN										COND	
4935-00-074-07900										X	
PRODUCTION SECTION										UNIT REPAIR	
ACQUISITION										CODE	
QTR 1										QTR 2	
QTR 3										QTR 4	
QTR 5										QTR 6	
QTR 7										QTR 8	
QTR 9										QTR 10	
QTR 11										QTR 12	
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QTR 639										QTR 640	
QTR 641										QTR 642	

CHAPTER III

DATA ANALYSIS

Of the 1400 organic MISTR national stock numbers surveyed, 197 of the stock numbers were changed with pen or pencil. These 197 pen or pencil changed items constitute the data population of interest. The "Decision Rules" for working this population are:

1. To use only those national stock numbers which reflect a pen or pencil change of three or more units. Any changes of less than three units is considered to be insignificant for the purpose of this thesis. There were 112 of the 197 pen or pencil changes which met this "Decision Rule" criterion.

2. There are twelve different Federal Supply Classification (FSC) items represented in the population of 197. A random sample was attempted, but consideration of quota sampling biased the sample. The quota sampling was deemed to be necessary because the random sample was heavily weighted toward certain FSCs. Table 3-1 depicts the number of national stock numbers by FSC that meet the requirement of Decision Rule 1. The quota sample selected for research is shown in the far right column.

TABLE 3-1

RESULTS BY FSC OF THE RANDOM/QUOTA SAMPLE
USED IN THIS THESIS

	<u>FSC</u>	<u>DECISION RULE 1 QUALIFIED</u>	<u>NUMBER IN SAMPLE SELECTED FOR RESEARCH</u>
1.	1560BJ	28	6
2.	5930	1	0
3.	6105	10	4
4.	6110	34	6
5.	6110NE	1	0
6.	6115	4	0
7.	6115UH	15	3
8.	6125	2	1
9.	6130	9	2
10.	6605BJ	1	0
11.	6610BJ	6	3
12.	6685BJ	1	0
	Totals:	<u>112</u>	<u>23</u>

FSC - Federal Supply Classification

BJ) - Materiel Management Aggregation Codification (MMAC).
 NE) These codes reflect Sacramento Air Logistics Center
 UH) as the sole manager regardless of the FSC.

The scope of the effect of the pen or pencil changes at Sacramento Air Logistics Center, I Division, is 25/197, or 12.7 percent. That is to say, of the total NSNs with pen or pencil changes (197) only twenty-five NSNs were selected for review. This is a selection percentage of 12.7. The sample of twenty-five national stock numbers with pen or pencil changes is depicted in Table 3-2.

A comparison of fourth quarter Fiscal Year 1979 and first quarter Fiscal Year 1980 D073.X21 reports was made. The purpose of the comparison was to assure that pen or pencil changes in the year 1980 were not the same as those in the fourth quarter Fiscal Year 1979.

Reduced Requirement

After reviewing the sample to be used in this thesis, it was determined that Material Requirements Lists (MRL), D049.445B, are needed to ascertain which parts are affected by reductions in requirements. A sample MRL is portrayed in Table 3-3. Table 3-2 shows there are fourteen national stock numbers (see asterisks) in the sample that were reduced in requirements. The MRLs were analyzed to review the impact of MISTR requirement reductions. MISTR requirement reductions may affect EOQ part support requirements. If the reduced MISTR requirement reflected a reduction in a certain

TABLE 3-2

PEN OR PENCIL CHANGE NATIONAL STOCK NUMBER

FY 80-1 Requirements

NSN	DPSH	<u>Computer Data</u>		<u>Pen or Pencil Changes</u>	
		<u>UNITS</u>	<u>TOTAL DPSH</u>	<u>UNITS</u>	<u>TOTAL DPSH</u>
1560 00 493 5186BJ	121.2	5	606	15	1818
6110 00 769 6537	4.2	46	193	*20	84
6105 00 538 8341	16.3	0	0	60	978
6105 00 539 9688	2.7	364	983	*173	467
1560 01 003 0715BJ	133.3	16	2133	*8	1066
6105 00 060 7024	7.4	75	555	*22	163
6610 00 225 7673BJ	1.25	73	91	*22	28
6110 00 561 1209	4.3	133	572	157	675
6125 00 843 5975	73.0	6	438	*0	0
1560 00 411 5028BJ	31.4	6	188	9	282
6130 00 863 5345	4.5	86	387	*32	144
6115 00 229 1715	17.2	64	1101	*55	946
6110 00 643 1118	6.2	123	763	*65	403

TABLE 3-2--Continued

		FY 80-1 Requirements			
NSN	DPSH	Computer Data		Pen or Pencil Changes	
		UNITS	TOTAL DPSH	UNITS	TOTAL DPSH
1560 00 080 3442BJ	292.2	7	2045	15	4383
6110 00 727 0792	4.3	255	1097	*68	292
6115 00 412 0340	40.4	34	1374	*28	1131
6130 00 537 0612	8.0	4	32	75	600
1560 00 080 3412BJ	292.2	23	6721	*8	2338
6115 00 818 8189	3.7	48	178	85	315
6110 00 925 9954	6.8	264	1796	*210	1428
6610 00 781 2573BJ	10.5	109	1145	158	1659
6105 00 826 3432	7.8	68	530	117	913
1560 00 197 0847BJ	35.1	0	0	24	842
6610 00 116 4624BJ	69.1	0	0	5	346
6110 00 690 2464	6.6	32	211	*13	86

NSN - National Stock Number

FY 80-1 - First Quarter Fiscal Year 1980

DPSH - Direct Product Standard Hours (These hours are the hours programmed by the organic maintenance facility to repair one of each of the above NSNs)

TABLE 3-3

MATERIAL REQUIREMENTS LIST

SHALC DIV-M REQ CODE-DT MATERIAL REQUIREMENTS LIST AS OF 09 NOV 79 PROD IDENT D049.4458 PAGE 7

CM NO	EI	NSN/MC/MDS	HMC	PART NO	FSCN	NOUN	ALC	DIV	EQSPEC	NO OVERHAULS	GFP NO				
14045		611000	9259954	305136-4-1	.99193	CONTROL	F	I	2H	0210					
ITEM NO	CI	NSN	HMC	PART NO	FSCN	NOUN	SHR	ERRC	PSC	UI	UNIT	PRICE	QPA	MRLX	QUANTITY
18		532000	2438378	MS20470A02-4	96906	RIVET	PA02Z	N	F	LB		9.15	0001	015	31.50
19		532000	7218973	MS20470A3-3	96906	RIVET	PA02Z	N	F	LB		5.19	0008	015	252.00

EOQ part in the amount of two or more units, or one hundred or more dollars, the EOQ part was considered a candidate for additional research. Seventeen SM-ALC EOQ parts were identified as meeting this unit and dollar reduction requirement (see Table 3-4). Requirement reduction resulted in only one national stock number exceeding approved levels. The approved level was exceeded because a due-in request could not be cancelled without penalty (15).

There were twenty-two Defense Logistics Agency (DLA) parts that also met this unit and dollar reduction requirement (see Table 3-5).

Seven of the twenty-two parts are managed at Defense General Supply Center (DGSC), Richmond, Virginia (S9G). DGSC advised that one item was excess and a second item was identified for disposal. Stock level adjustments would have been made to avoid an excess of NSN 6115 00 635 3663, if the IMS had been made aware earlier of the reduction in requirement for the first quarter Fiscal Year 1980. The second item, NSN 5977 00 728 8113, was flagged for disposal because of a lack of requisitions compared to the stock level. The other five S9G parts were not affected by the reduced requirement. There was no effect because other users had requisitioned the possible excess, or there had been no previous action taken to increase stock levels on the parts.

TABLE 3-4

REDUCED SM-ALC EQ REQUIREMENT		ALC SUPPLY/ MANAGER DESIGNATOR		APPROXIMATE TOTAL DOLLARS REDUCED
EQQ NSN	MANUALLY REDUCED MISTR REQUIREMENT FY 80-1			
6125 00 628 0948	54 Units	FFZ/16C		\$ 1,907
4140 00 023 2597UH	54 Units	FFZ/IFA		10,528
6115 00 469 1121	2 Units	FFZ/IFC		212
6115 00 792 4390UH	63 Units	FFZ/IFB		6,922
5950 00 735 6146YV	5 Units	FFZ/IFR		165
6115 00 643 4239UH	39 Units	FFZ/IFB		52,688
6110 00 949 0128YV	2 Units	FFZ/IFR		289
6110 00 924 8726YV	3 Units	FFZ/IFR		365
5950 00 735 7144YV	5 Units	FFZ/IFR		150
2920 00 931 5544YV	54 Units	FFZ/IFR		133
6105 00 941 9538	33 Units	FFZ/IFN		682
6105 00 737 9446	19 Units	FFZ/IFN		3,872
5105 00 737 9436	46 Units	FFZ/IFN		17,075
6105 00 594 5147	21 Units	FFZ/IFN		4,067
6105 00 118 0253	191 Units	FFZ/IFN		2,002
6110 00 678 1954	58 Units	FFZ/IFK		588
5950 00 067 0418YV	8 Units	FFZ/IFR		1,775
Total:				\$103,420

NSN
 EQQ
 FFZ/I...
 FY80-1
 MISTR

-National Stock Number
 -Equipment Ordering Quantity
 -Sacramento Air Logistics Center/Item Manager Designator
 -First Quarter, Fiscal Year 1980
 -Management of Items Subject to Repair

TABLE 3-5

REDUCED DEFENSE LOGISTICS AGENCY EOQ REQUIREMENT

<u>EOQ NSN</u>	<u>MANUALLY REDUCED MISTR REQUIREMENT FY 80-1</u>	<u>MANAGER</u>	<u>APPROXIMATE TOTAL DOLLARS REDUCED</u>
5961 00 043 4622	31 Units	S9E	\$ 100
5910 00 957 2919	10 Units	S9E	115
5950 00 903 6006	10 Units	S9E	564
5950 00 903 6014	12 Units	S9E	1,817
5961 00 015 0087	10 Units	S9E	120
5910 00 949 7351	54 Units	S9E	1,955
5915 00 996 1881	5 Units	S9E	152
5950 00 280 4939	6 Units	S9E	485
5950 00 725 1928	12 Units	S9E	485
5999 00 967 6036	5 Units	S9E	371
5910 00 875 7101	4 Units	S9E	190
5950 00 953 3070	4 Units	S9E	660
6120 00 014 5663	3 Units	S9G	1,309
5977 00 345 9776	504 Units	S9G	706
5977 00 578 7913	101 Units	S9G	367
6115 00 347 4884	34 Units	S9G	225
6115 00 635 3663	11 Units	S9G	18,232
5977 00 143 6774	40 Units	S9G	371
5977 00 728 8113	4 Units	S9G	135
5320 00 721 8973	65 Units	S9I	336
5310 00 810 1786	32 Units	S9I	627
5360 00 345 9777	504 Units	S9I	827
		<u>Total:</u>	\$30,149

NSN - National Stock Number
 EOQ - Equipment Ordering Quantity
 S9E - Defense Electronics Supply Center, Dayton, OHIO
 S9G - Defense General Supply Center, Richmond, Virginia
 S9I - Defense Industrial Supply Center
 Philadelphia, Pennsylvania
 FY80-1 - First Quarter Fiscal Year 1980
 MISTR - Management of Items Subject to Repair

Twelve of the twenty-two parts are managed at Defense Electronics Supply Center, Dayton, Ohio (S9E). None of the reduced MISTR requirements resulted in a surplus of these twelve items.

Three of the twenty-two parts are managed at Defense Industrial Supply Center, Philadelphia, Pennsylvania (S9I). None of the reduced MISTR requirements resulted in a surplus of these three items.

Increased Requirement

The pen or pencil changes to the D073.X21 report resulted in an increased requirement for MISTR items. Seven of eleven MISTR items that were increased, Table 3-6, resulted in customer backorders. These backorders are identified on the maintenance portion of the MISTR system, G019C.

Only one of the six SM-ALC IMSs for EOQ parts stated that stock levels would have been increased if earlier notification of the MISTR adjustments had been provided (NSN 1560 00 083 0553BJ).

Both S9E parts levels were adversely affected by the pen or pencil unprogrammed increases of the MISTR items. The IM advised that with earlier notification of the increased requirements he would have at least had the option of increasing buys on open contract.

TABLE 3-6

MISTR ITEM BACKORDERS DUE TO PARTS SHORTAGES

NSN MISTR ITEM	B/O	EOQ NSN CAUSE/MANAGER	MISTR COMPUTER LISTED QTY. (DO73.X21) FY80-1	MISTR IMS PEN OR PENCIL QTY. CHANGES FY80-1
1560 00 493 5786BJ	2	Local Manufactured Part/FFZ	5	15
1560 00 411 5028BJ	20	1560 00 400 9369BJ/FFZ 1560 00 192 5136BJ/FFZ	6	9
1560 00 080 3442BJ	5	Indirect Material	7	15
6130 00 537 0612	2	5961 00 365 6413/S9E	4	75
6610 00 781 2573BJ	2	5999 00 065 4768/S9E	109	158
2 1560 00 197 0847BJ	2	1560 00 050 0788BJ/FFZ 1560 00 292 9283BJ/FFZ 1560 00 083 0553BJ/FFZ 1560 00 997 7732BJ/FFZ	0	24
6610 00 116 4624BJ	2	3020 00 689 9429/S9C	0	5

NSN - National Stock Number	S9C - Defense Construction Supply Center
EOQ - Equipment Ordering Quantity	FY80-1 - First Quarter, Fiscal Year 1980
FFZ - Sacramento Air Logistics Center	MISTR - Management of Items Subject to Repair
S9E - Defense Electronic Supply Center	B/O - Backorders

The MISTR backorders generated by the local manufactured not stock listed item will be addressed in Chapter 4.

Earlier notification of an increase in requirement for S9C managed part, NSN 3020 00 689 9429, would have had little affect on the backorders of MISTR item, NSN 6610 00 116 4624BJ. This is because the item is coded BV which means it is shipped direct from the contractor to the user. A history of this part shortage led to the BV coding (7). It is important to realize that there is no formal procedure available to notify S9C when there will be an increase in support requirements due to MISTR adjustments (10). S9C will buy on requisitions and Supply Support Requests (SSRs). However, SSRs are for use only with new or one time requirements brought into the system.

MISTR item, NSN 1560 00 080 3442BJ, will not be addressed because backorders were not caused by delayed parts support.

Summary

Only 12.7 percent of the pen or pencil changed MISTR items managed and repaired at SM-ALC/MMI were researched in depth. These researched items show an unprogrammed reduction of \$103,420 of EOQ parts. For the most part, the EOQ Item Managers were not adversely affected by the requirements

reduction. However, approximately \$25,000 of these EOQ parts became excess. There were three of the sample of twenty-five MISTR items (or 12 percent) that could have received improved parts support if earlier notification of the MISTR requirement changes had been received by appropriate Item Managers.

CHAPTER IV

Conclusion

A review of the analysis is in order. Twenty-five investment items were researched:

1. Six of the items reflected some degree of adversity caused by the pen or pencil changes.

2. The pen or pencil changes showed a reduction of \$103,420 in EOQ parts support.

3. Approximately \$25,000 worth of EOQ parts were left in surplus as a result of the pen or pencil changes.

In view of the above, it appears that notification to the EOQ IMS by the Investment IMS at the time pen or pencil changes are made to the computed MISTR requirement is in order. The early notification would:

1. Allow the parts support IMS to take timely action to reduce the number of buys on Purchase Request/Military Interdepartmental Purchase Request in consonance with the IMS' support position.

2. Allow the parts support IMS to provide more time to obtain the parts and fulfill the requirement. The initial requirement earmarked for organic repair is made known to the MISTR IMS approximately seventy-five days before actual

requisitions for parts support would impact the D062 or the Standard Automated Material Management System (SAMMS) used by Defense Logistics Agency (DLA) managers.

3. Allow the parts support IMS to better control the DLA parts support capability.

This research did show that though the Navy was frequently the user of the same part as the Air Force, their influence on the MISTR parts shortage addressed in this thesis was minimal.

Recommendations

It is recommended that the MISTR IMS be required to notify the appropriate part IMSs of MISTR investment items that are manually changed by three or more units, and valued at \$100 or more. The IMS would require the assistance of the Production Management Specialist (PMS) and the Equipment Specialist (ES) to determine the unfavorable impact of the adjusted parts support. The effort they would expend to provide this information would be minimal. Present tasking requires the PMS to formalize the pen or pencil changes to the computed requirement by submitting an updated Workload Source Objective (WSO) (D073.X11) (5:2-2). The production and support part information could be provided to the IMS at this time. However, time would

necessarily be of the essence to make the notifications meaningful. The parts IMS could then take action, as deemed necessary, to either reduce or increase parts on buy.

It is also recommended that all parts used having a recurring demand be stock listed. Recurring demands without national stock numbers were encountered in support of investment item NSN 1560 00 493 5186BJ. This condition has been observed on several occasions. A one-time buy or local manufacture of parts occurs to provide repair support for approximately six months. Parts consumption occurs without demand records since stock numbers have not been assigned and computer data has not been maintained. The various computer requirement systems are geared to be managed by national stock numbers. Paragraph 7-3a of AFLCR 72-2 states in substance that the management portion of Air Force Form 86 (Request for Cataloging Data/Action) will be used in preparation of all new Item Identifications (IIs) and, as applicable, for requesting catalog changes. Further, Paragraph 8-2 of AFLCR 82-2 states: "...FSC IM/SMs are responsible for the preparation of ALC generated AF form 86s." It is recommended that AF form 86 stock number requirement for additional items that are determined necessary during the repair process, should be submitted by the organic

repair facility. Material Requirement Lists containing items without stock numbers and provided to the maintenance facility are inviting high backorders and low fill rates.

Each quarter there is a meeting of the IMS/PMS to review repair requirements for the upcoming quarter. At this meeting manual requirement changes are reviewed and a final determination of repair requirements is made. Requirements that are changed are identified on an Air Force form 1530, Punch Card Transcript, for key punch and computer input to update the WSO (D073.211). It is recommended that the D049 also be programmed to accept these final repair changes. However, computer inputs to the D049 would be for only three or more units. The newly programmed D049 could provide a readout as follows:

1. National Stock Number of MISTR item
2. National Stock Number of part
3. Noun of the part
4. Firm requirement for the next two fiscal year quarters
5. Estimated funds required to provide the necessary support for the next two fiscal year quarters

The readouts from the D049 could interface with either the

D032 or the D071 to identify the part IMS. The readouts could then be distributed to the appropriate manager of the part. The D049 readout would offer firm information on forthcoming depot requisitions for each part affected by the change. Information would be available approximately fifty days prior to incoming requisitions. During this period, the parts IMS should take appropriate requisitioning action. The D049 programming change suggested will provide early requirements notification, save numerous manhours by using computer data, and provide the IMS with an authoritative document to support funds expenditures or reduction.

Recommendations for Further Study

Further study in the parts support area is in order. The Management of Items Subject to Repair (MISTR) system directly influences and affects Air Force parts support. There are no theses on file at the Air Force Institute of Technology (AFIT) on either parts support or the MISTR system, and yet requests for research remain on file. The United States Air Forces in Europe (USAFE) has requested AFIT to consider the problems of parts support as a thesis topic (File Number 12-2). Also, the Air Force Logistics Command (AFLC) has requested AFIT to provide research on Spare Parts and Repairable Equipment Requirements (File Number 12-0). Further, the Item Management Division,

Sacramento Air Logistics Center, McClellan Air Force Base, California, is the sponsor of this thesis.

One topic that warrants research in the parts support area concerns recurring requisitions for nonstock-listed parts. The researcher could flag the various nonstock-listed part requisitions that are generated at the repair facility and investigate the reason for the requisitions. Research may indicate that Paragraph 8-2 of AFLCR 72-2, which requires AF form 86 submitting by the IM/SM, should be changed to assign stock number request responsibility to the maintenance facility.

Another topic which justifies research relates to the negative impact that pen or pencil changes to the MISTR requirements have on the ALC Material Management and Maintenance Directorate's manpower effectiveness. Material Management manpower accounting effectiveness relates directly to the number of actions generated by the MISTR reports (G019C). Lower manpower effectiveness ratings can occur when pen or pencil changes reduce the number of MISTR actions. Higher manpower effectiveness results when the number of pen or pencil changes increase the number of MISTR actions.

Maintenance manpower effectiveness is impaired as the result of all MISTR requirement changes. Pen or pencil

changes cause last minute shuffling of skilled workers. This shuffling is necessary so that manhours can remain within each quarter's Planned Labor Capability. Changes of over 1700 manhours are identified in Table 3-2.

Data in Tables 4-1 and 4-2 may help researchers be aware of the reasons associated with requirement changes. Table 4-1 identifies changes of 197 national stock numbers reviewed in this thesis research. The reasons for the pen or pencil changes in the sample of twenty-five NSNs researched are depicted in Table 4-2.

A System Perspective

A final recommendation for further study is related to depot repair of MISTR items for application of the systems approach to the study of real-world phenomena (13:261). The manager must look at the whole MISTR system to understand how customer support is affected by the numerous activities involved. For instance, it may be neither efficient nor effective to pay additional funds to accelerate the manufacture of a part that sits at a truck terminal awaiting a full truckload before it is transported to the repair facility.

There are a myriad of reasons for not getting a repaired MISTR item to the customer in time to avoid high

TABLE 4-1
REASONS FOR PEN OR PENCIL CHANGES
POPULATION

<u>REASON FOR CHANGE</u>	<u>NO. OF DIFFERENT NSNs CHANGED</u>
Usage Factors, Plus	46
Usage Factors, Minus	25
Usage Factors Error, Plus	18
Usage Factors Error, Minus	2
Program Changes, Plus	23
Program Changes, Minus	9
I & S Group Changes, Plus	2
I & S Group Changes, Minus	4
Base Safety Level, Plus	2
NSO/INS Error, Plus	3
NSO/INS Level, Plus	31
Repair Leadtime Requirement, Plus	1
FMS Additive, Plus	5
Additive Requirements, Plus	10
Interim Contract Support, Minus	2
Serviceable, Plus	1
Unserviceable, Minus	1
Due-In From Overhaul, Plus	11
Due-In Assets	1
Total:	<u>197</u>

Notes: NSN - National Stock Number
I&S - Interchangeable and Substitution
NSO - Numerical Stock Objective
INS - Insurance Item
FMS - Foreign Military Sales

TABLE 4-2
REASONS FOR PEN OR PENCIL CHANGES
SAMPLE

<u>NATIONAL STOCK NUMBER</u>	<u>REASON FOR CHANGE</u>
1. 1560 00 493 5186BJ	Usage Factors
2. 6110 00 796 6537	Usage Factors
3. 6105 00 538 8341	Usage Factors
4. 6105 00 539 9688	Usage Factors
5. 1560 01 003 0715BJ	Usage Factors
6. 6105 00 060 7024	Usage Factors
7. 6610 00 225 7673BJ	Usage Factors
8. 6110 00 561 1209	Due in From Overhaul
9. 6125 00 843 5975	Unserviceable
10. 1560 00 411 5028BJ	Error, Usage Factor
11. 6130 00 863 5345	Error, Usage Factor
12. 6115 00 229 1715UH	Program Change
13. 6110 00 643 1118	Usage Factors
14. 1560 00 080 3442BJ	Usage Factors
15. 6110 00 727 0792	Program Change
16. 6115 00 412 0340UH	Program Change
17. 6130 00 537 0612	Additive Requirement
18. 1560 00 080 3412BJ	Usage Factors
19. 6115 00 818 8189UH	Program Change
20. 6110 00 925 9954	Usage Factors
21. 6610 00 781 2573BJ	Usage Factors
22. 6105 00 826 3432	Usage Factors
23. 1560 00 197 0847BJ	Program Change
24. 6610 00 116 4624BJ	Usage Factors
25. 6110 00 690 2464	Usage Factors

ALC backorders and low ALC fill rates. These reasons and the many variables that interact to influence customer support, can be depicted in a dynamic Q-GERT model. Models are descriptions of systems (12:1) and Q-Gert (Queue-Graphical Evaluation and Review Technique) employs an activity-on-branch network philosophy in which a branch represents an activity that involves a processing time or a delay. Nodes are used to separate branches and are used to model milestones (12:3). A network of a model of the depot repair system is shown in Figure 4-1. A simple schematic flow in the language of GERTS (Graphical Evaluation and Review Technique Simulation) for this model is provided in Figure 4-2. Information external to the boundry of interest has been excluded.

This system model was deliberately left until last to emphasize its importance in a future recommended study. It is apparent that the value of analysis is not wrapped up in numbers and variances of meaning between "X" or "Y" unfulfilled component requirements. Rather, analysis must be centered on the timeliness and appropriateness of communication. Study of the communication flow is necessary if further improvements are to be found.

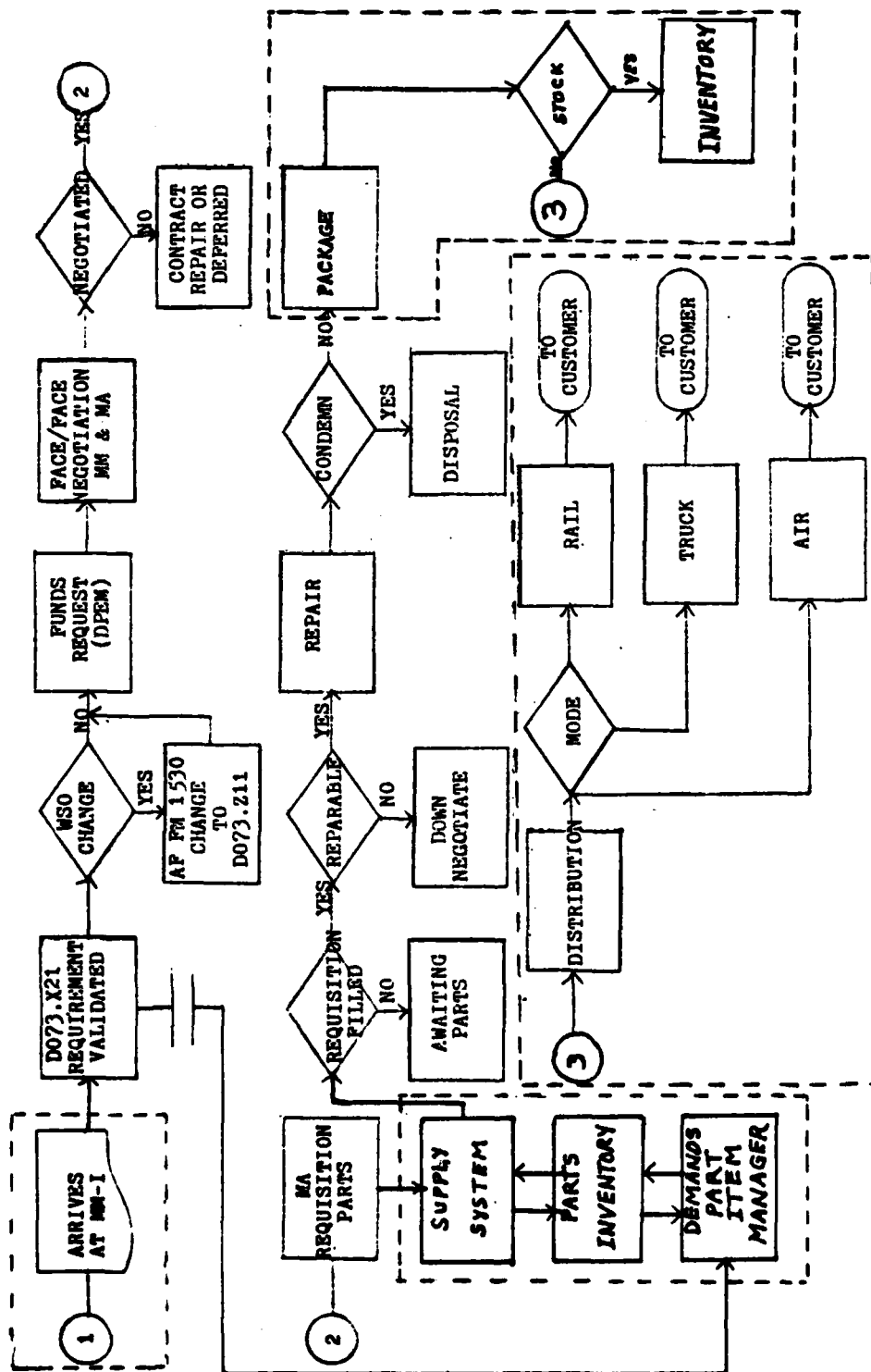


Fig 4-1. Manual Scrub System

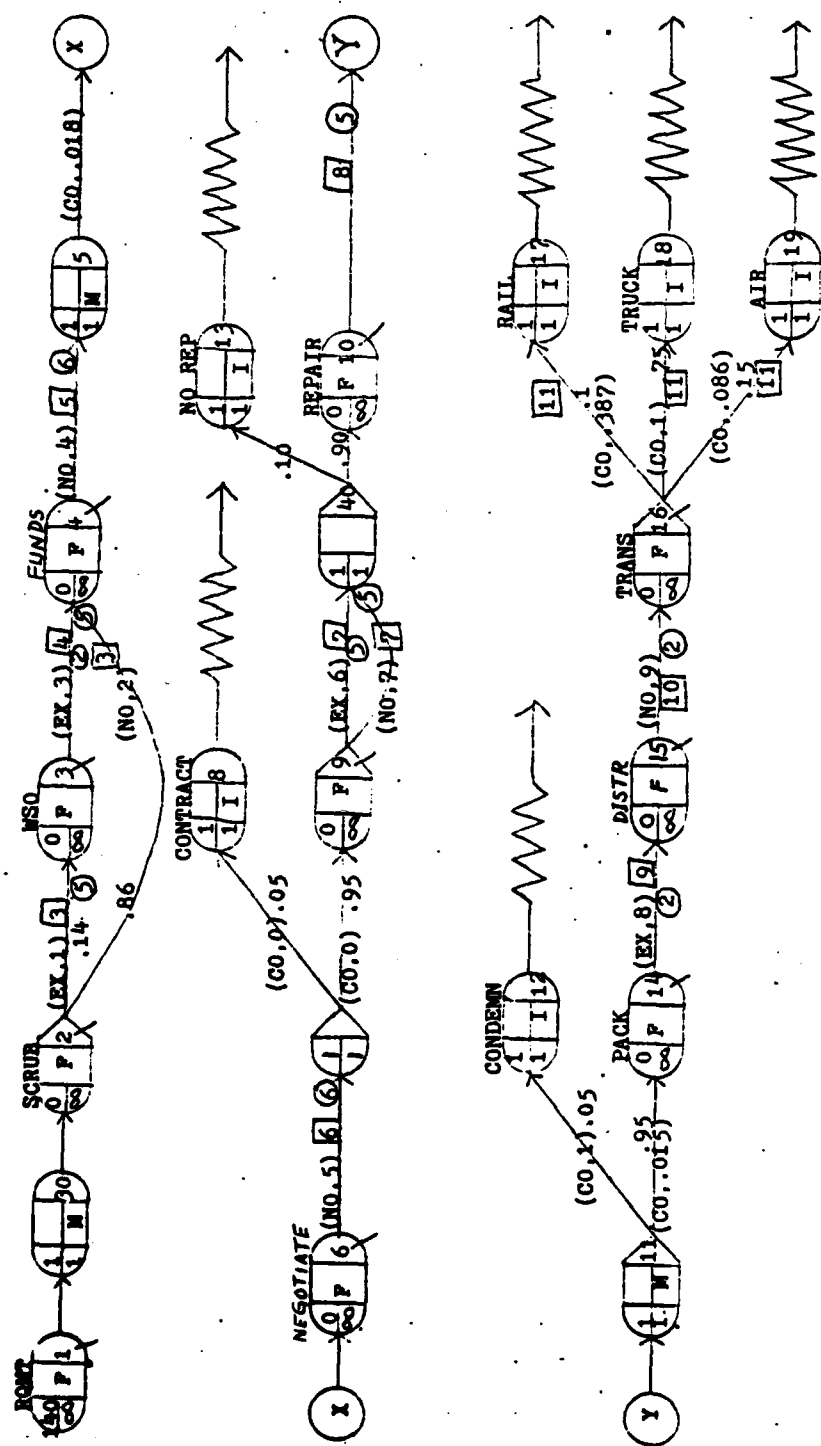


Fig 4-2. Q-GERTS Model

APPENDIX

LIST 1 OF INPUT DATA TO Q-GERTS

*** INPUT CARDS ***

GEN,MCGUIRE,MAT50,04,22,1980,0,6,140,90,25*
 QUE,1/REQT,140,,D,F*
 ACT,1,30*
 REG,30,1,1,D,M*
 ACT,30,2*
 QUE,2/SCRUB Q,0,,P,F*
 ACT,2,3,EX,1,3,5,0.14*
 ACT,2,4,NO,2,3,5,0.86*
 QUE,3/WSO Q,0,,D,F*
 ACT,3,4,EX,3,4,2*
 QUE,4/FUNDS Q,0,,D,F*
 ACT,4,5,NO,4,5,6*
 REG,5,1,1,D,M,L*
 ACT,5,6,CO,0.018*
 QUE,6/NEGO,0,,D,F*
 ACT,6,7,NO,5,6,6*
 REG,7,1,1,P*
 ACT,7,8,(8)0.05*
 ACT,7,9,(8)0.95*
 SIN,8/CONTRACT,1,1,D,I*
 QUE,9/ORDER,0,,P,F*
 ACT,9,40,EX,6,7,5,0.04*
 ACT,9,40,NO,7,7,5,0.96*
 REG,40,1,1,P*
 ACT,40,13,(8)0.10*
 ACT,40,10,(8)0.90*
 QUE,10/REPAIR Q,0,,D,F*
 ACT,10,11,CO,1,8,5*
 REG,11,1,1,P,M,L*
 ACT,11,12,CO,1,(8)0.05*
 ACT,11,14,CO,0.015,(8)0.95*
 SIN,12/CONDEMN,1,1,D,I*
 SIN,13/NO REP,1,1,D,I*
 QUE,14/PACKING,0,,D,F*
 ACT,14,15,EX,8,9,2*
 QUE,15/DISTIB,0,,D,F*
 ACT,15,16,NO,9,10,2*

QUE,16/TRANS,0,,P,F*
ACT,16,17,CO,0.387,11,1,0.1*
ACT,16,18,CO,0.1,11,1,0.75*
ACT,16,19,CO,0.086,11,1,0.15*
SIN,17/RAIL,1,1,D,I*
SIN,18/TRUCK,1,1,D,I*
SIN,19/AIR,1,1,D,I*
PAR,1,.6,0.0,50.0*
PAR,2,.5,0.0,50.0,.1*
PAR,3,1.75,0.0,50.0*
PAR,4,3.5,0.0,50.0,.06*
PAR,5,3.17,0.0,50.0,.02*
PAR,6,4.5,0.0,50.0*
PAR,7,1.5,0.0,50.0,.005*
PAR,8,.75,0.0,50.0*
PAR,9,.75,0.0,50.0,.005*
FIN*

*** NO ERRORS DETECTED IN INPUT DATA ***

LIST 2 OF INPUT DATA TO Q-GERTS

*** INPUT CARDS ***

GEN,MCGUIRE,MAT30,04,22,1980,0,6,140,90,25*
 QUE,1/REQT,140,,D,F*
 ACT,1,30*
 REG,30,1,1,D,M*
 ACT,30,2*
 QUE,2/SCRUB Q,0,,P,F*
 ACT,2,3,EX,1,3,5,0.14*
 ACT,2,4,NO,2,3,5,0.86*
 QUE,3/WSO Q,0,,D,F*
 ACT,3,4,EX,3,4,2*
 QUE,4/FUNDS Q,0,,D,F*
 ACT,4,5,NO,4,5,6*
 REG,5,1,1,D,M,L*
 ACT,5,6,CO,0.018*
 QUE,6/NEGO,0,,D,F*
 ACT,6,7,NO,5,6,6*
 REG,7,1,1,P*
 ACT,7,8,(8)0.05*
 ACT,7,9,(8)0.95*
 SIN,8/CONTRACT,1,1,D,I*
 QUE,9/ORDER,0,,P,F*
 ACT,9,10,EX,6,7,5,0.04*
 ACT,9,10,NO,7,7,5,0.96*
 QUE,10/REPAIR Q,0,,D,F*
 ACT,10,11,CO,1,8,5*
 REG,11,1,1,P,M,L*
 ACT,11,12,CO,1,(8)0.05*
 ACT,11,13,CO,1,(8)0.10*
 ACT,11,14,CO,0.015,(8)0.70*
 ACT,11,14,CO,1.75,(8)0.15*
 SIN,12/CONDEMN,1,1,D,I*
 SIN,13/NO REP,1,1,D,I*
 QUE,14/PACKING,0,,D,F*
 ACT,14,15,EX,8,9,2*
 QUE,15/DISTIB,0,,D,F*
 ACT,15,16,NO,9,10,2*
 QUE,16/TRANS,0,,P,F*
 ACT,16,17,CO,0.387,11,1,0.1*
 ACT,16,18,CO,0.1,11,1,0.75*
 ACT,16,19,CO,0.086,11,1,0.15*

SIN,17/RAIL,1,1,D,I*
SIN,18/TRUCK,1,1,D,I*
SIN,19/AIR,1,1,D,I*
PAR,1,.6,0.0,50.0*
PAR,2,.5,0.0,50.0,.1*
PAR,3,1.75,0.0,50.0*
PAR,4,3.5,0.0,50.0,.06*
PAR,5,3.17,0.0,50.0,.02*
PAR,6,4.5,0.0,50.0*
PAR,7,1.5,0.0,50.0,.005*
PAR,8,.75,0.0,50.0*
PAR,9,.75,0.0,50.0,.005*
FIN*

*** NO ERRORS DETECTED IN INPUT DATA ***

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BIOGRAPHICAL SKETCH OF THE AUTHOR

Matthew R. McGuire was born in 1924. He spent fourteen months in a German prisoner of war camp during World War II. After more than twenty-two years of service in the U.S. Air Force, he entered the U.S. Air Force civil service in 1967. Mr. McGuire received a B.A. degree in the Social Sciences from California State University, Sacramento, in 1972. He was accepted in the Junior Administrative Development Examination (JADE) program at McClellan Air Force Base, California, for training as an Industrial Specialist in 1974. In 1975 he received his present job title of Production Management Specialist. He is presently scheduled to return to Sacramento Air Logistics Center, McClellan Air Force Base, California, to continue in his old position.